*Zootaxa* 1857: 66–68 (2008)
www.mapress.com/zootaxa/


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ISSN 1175-5326 (print edition)
**ZOOTAXA**
ISSN 1175-5334 (online edition)

# The tadpole of the bamboo–breeding poison frog *Ranitomeya biolat* (Anura: Dendrobatidae)

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*Ranitomeya biolat* occurs in the lowland rainforest of southern Peru and northwestern Bolivia and uses bamboo internodes as a retreat and reproduction site (Morales 1992; Maldonado & Reichle 2007). Unlike other members of the *vanzolinii* group, which exhibit biparental care of tadpoles (Summers & McKeon 2004), we have observed that *R. biolat* exhibits male–only parental care and that tadpoles are transported individually and deposited in water–filled bamboo internodes (Medina–Müller 2006; R. von May, unpublished data). After more than 12 months of sampling, we never observed individuals providing trophic eggs to tadpoles or observed oophagy as clutches were laid 3.5 ± 1.5 cm above the water (n = 55); hence, tadpole oophagy may not be an important food resource as previously suspected (Waldram 2008). Though basic information on its breeding biology has been published (Waldram 2008), its tadpole remains undescribed. With the purpose of filling this gap, we here describe the tadpole of *R. biolat*.

Twenty tadpoles (MUSM–27564) were collected at the Los Amigos Research Center (SE Perú, 12°34'07" S, 70°05'57" W; 270 m elevation) in March 2003 and March 2007, and were fixed and stored in 10% formalin. Descriptions follow the format of Caldwell *et al.* (2002) and measurements (to nearest 0.01 mm) were made using a Nikon SMZ 800 dissenting microscope with a micrometer scale attached to an ocular lens. Terminology follows Altig & McDiarmid (1999). Drawings of a single specimen were made by MMM using a camera lucida attached to the microscope. The morphology of all the other individuals observed was similar in appearance (n = 19). Morphometric measurements were taken from 18 tadpoles (Table 1). Changes in color pattern were observed in 12 tadpoles growing in bamboo sections attached to bamboo stems. Voucher specimens were deposited in the herpetological collection at the Museum of Natural History, Universidad Nacional Mayor de San Marcos, Lima, Perú.

**Description of tadpoles**. This description is based on one tadpole at Gosner stage 32 (MUSM–27564). Measurements are in mm. A tadpole from the same series is illustrated in Figure 1. Total length 20.90; body length 8.10. Body depressed in lateral view, ovoid in dorsal view. Snout broadly rounded in dorsal view and narrowly rounded in lateral view. Nares directed anterolaterally, opening 2.20 from snout; internarial distance 1.25. Distance from nostril to eye 1.35. Eyes located dorsally, directed dorsolaterally; eye diameter 0.59, interorbital distance 2.05. Spiracle sinistral; free short tube, directed posterodorsally. Distance from snout to spiracle opening 5.05, thus, spiracle located just below midline of 55.5% of body length from snout. Vent tube distinct and free, posterior, opening dextrally, 0.90 in length. Tail length 12.8. Notochord ends 0.75 from narrowly rounded tail tip. Upper fin slightly higher than lower fin; upper fin originates anterior to junction of body and tail. At midtail, upper fin 1.00 and lower fin 0.85. Tail muscle is 3.60 deep at base of tail, maintains a constant depth past one–half of tail.

**Oral disc.** Oral disc ventral; width of disc 2.10, disc 33.0% of maximum body width. Laterally and ventrally, disc is surrounded by several small marginal papillae. Papillae are simple and conical, forming a single row on lateral and posterior edges of oral disc; anterior edge of oral disc with a gap. LTRF is 2(2)/3(1). Upper jaw higher than lower jaw; both black and keratinized with fine triangular serrations. Tooth row A–1 complete, 1.43 in length; A–2 consists of two short widely separate rows at level of upper jaw, 0.18 in length. A–2 gap 0.29. Tooth row P–1 composed by two long separate rows, 0.17; P–1 gap 0.14. Tooth row P–2 complete, 0.57, slightly longer than P–3. Tooth row P–3 complete, 0.44 in length.

**Color in life.** Dorsum of body gray–brown; anterior half is gray–brown translucent with a dark brown stripe that

 *Accepted by M. Vences: 4 Aug. 2008; published: 27 Aug. 2008*

extends from top of snout to dorsal fin. Posterior half of body is dark gray–brown from the intestines. Tail is pale and translucent gray–brown. Yellow spots on head appeared on day 44.67 (± 10.40, standard deviation), yellow lines on head and body appeared on day 52.25 (± 10.23) yellow lateral lines were complete on day 76.00 (± 5.83). Metamorphosis took 69–101 days to be completed (n = 12).

**TABLE 1.** Morphometric measurements (in mm) based on 18 tadpoles of *R. biolat*, Gosner stages 25–36. Not all stages are represented. Mean ± Standard deviation are given when n > 1.

| Character | Stage 25 (n = 2) | Stage 26 (n = 3) | Stage 28 (n = 1) | Stage 29 (n = 1) | Stage 30 (n = 1) | Stage 32 (n = 2) | Stage 34 (n = 4) | Stage 36 (n = 4) |
|---|---|---|---|---|---|---|---|---|
| Total length | 11.35 ± 0.21 | 13.10 ± 0.36 | 20.7 | 18.7 | 21.0 | 20.70 ± 0.28 | 22.25 ± 1.44 | 24.30 ± 0.99 |
| Body length | 4.85 ± 0.21 | 6.70 ± 1.08 | 8.2 | 7.7 | 9.0 | 8.05 ± 0.07 | 9.23 ± 0.46 | 9.73 ± 0.36 |
| Tail length | 6.50 ± 0.00 | 6.40 ± 0.95 | 12.5 | 11.0 | 12.0 | 12.65 ± 0.21 | 13.03 ± 1.00 | 14.58 ± 1.25 |
| Internarial distance | 0.87 ± 0.11 | 1.13 ± 0.19 | 1.5 | 1.1 | 1.3 | 1.30 ± 0.07 | 1.55 ± 0.31 | 1.63 ± 0.10 |
| Interorbital dist. | 1.27 ± 0.18 | 1.73 ± 0.20 | 2.1 | 1.9 | 2.1 | 2.10 ± 0.07 | 2.43 ± 0.06 | 2.70 ± 0.17 |
| Eye diameter | 0.40 ± 0.07 | 0.47 ± 0.15 | 0.7 | 0.5 | 0.8 | 0.67 ± 0.11 | 0.81 ± 0.11 | 0.80 ± 0.12 |
| Vent tube | 0.35 ± 0.00 | 0.88 ± 0.76 | 0.7 | 0.5 | 0.8 | 0.80 ± 0.14 | 0.91 ± 0.14 | 0.85 ± 0.18 |
| Spiracle | 0.80 ± 0.14 | 0.72 ± 0.16 | 1.1 | 1.0 | 0.7 | 0.88 ± 0.18 | 0.99 ± 0.02 | 1.10 ± 0.17 |
| Tail muscle width | 0.88 ± 0.11 | 1.17 ± 0.25 | 1.5 | 1.6 | 1.8 | 1.53 ± 0.18 | 1.93 ± 0.13 | 2.24 ± 0.51 |
| Nostril–eye dist. | 0.85 ± 0.21 | 1.08 ± 0.13 | 1.4 | 1.3 | 1.3 | 1.33 ± 0.04 | 1.46 ± 0.08 | 1.66 ± 0.56 |
| Snout–spiracle dist. | 3.25 ± 0.00 | 4.18 ± 0.32 | 5.1 | 5.1 | 5.2 | 5.03 ± 0.04 | 5.40 ± 0.44 | 5.50 ± 0.39 |
| Upper fin (midtail) | 0.53 ± 0.04 | 0.50 ± 0.22 | 0.5 | 0.9 | 1.3 | 0.70 ± 0.42 | 1.23 ± 0.31 | 1.21 ± 0.14 |
| Lower fin (midtail) | 0.33 ± 0.04 | 0.47 ± 0.19 | 0.4 | 0.8 | 1.1 | 0.60 ± 0.35 | 1.33 ± 0.50 | 1.13 ± 0.33 |
| Oral disc width | 1.57 ± 0.45 | 1.68 ± 0.18 | 1.9 | 2.0 | 2.2 | 2.15 ± 0.07 | 2.20 ± 0.19 | 2.31 ± 0.05 |

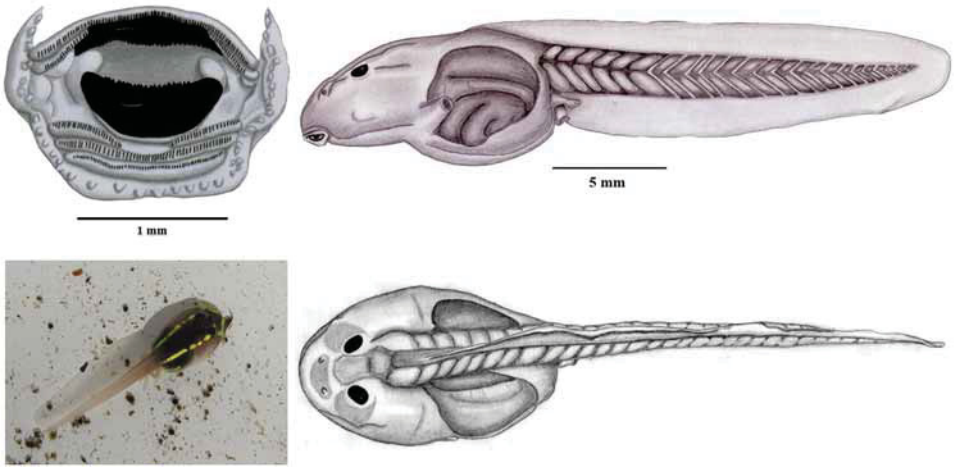


**FIGURE 1.** Oral disc (top left), lateral view (top right), and dorsal view (bottom right) of preserved tadpole of *R. biolat* stage 34 (MUSM–27564). A live tadpole (bottom left) in stage 40 (Photo by Jennifer Jacobs).

**Color in preservative.** Dorsum of body pale brown with darker brown spots. A dark brown stripe extends posteriorly of eyes on dorsal part of body. Pale brown to cream around the eyes. Tail musculature cream with dense minute brown spots. Tail fins translucent cream with irregular dark brown spots. Anterior half of venter white with irregular brown blotches; posterior half of venter dark, from the intestines visible through skin. Unpigmented transversal band between oral disk and belly.

The tadpole of *R. biolat* conforms to a generalized lentic, nektonic form (Altig & McDiarmid 1999). Its external morphology resembles that of other dendrobatid species (generally with depressed body, dorsally–located eyes, and relatively high fins) and in particular, it conforms to the characteristic larval morphology of *Ranitomeya* by having a dextral vent tube and a "normal" (not umbelliform) and emarginate oral disc (Grant *et al.* 2006). *R. imitator* is a closely related species whose larvae have been partially described (Schulte 1986; larvae of other species in the *vanzolinii* group have not

been described) and whose tadpoles are gray–green (gray–brown in *R. biolat*) and, in dorsal view, are widest on posterior one–fourth of body (widest on midbody in *R. biolat*). The presence of developed beaks may improve the chances of capturing and consuming mosquito larvae or conspecific tadpoles (Caldwell & de Araujo 1998). Previous work has shown that tadpoles of *R. biolat* feed on mosquito larvae, although they would cannibalize conspecific tadpoles when deposited in the same internode (Medina–Müller 2006).

**Acknowledgements**

We thank Jennifer Jacobs, Kate Smith, Nemesio Carrillo, and Roy Santa Cruz for help in field work. Nigel Pitman, Jesús Ramos, and staff at Los Amigos provided logistical support. Edgar Lehr, Jennifer Jacobs, César Aguilar, and Jason Brown provided constructive comments on the manuscript. Research permits were issued by INRENA, Perú (authorizations 012–2003–INRENA–IFFS–DCB and 67–2007–INRENA–IFFS–DCB). Field work was funded as part of a larger project by National Geographic Society (grant 7658–04 to KS), National Science Foundation (IOB–0544010 to KS), and Amazon Conservation Association (to MMM and RvM).

**References**

Altig, R. & McDiarmid, R.W. (1999) Body plan. Development and morphology. *In*: McDiarmid, R.W. & Altig, R. (Eds.), *Tadpoles. The Biology of Anuran Larvae*. The University of Chicago Press. Chicago, pp. 24–51.

Caldwell, J. & de Araujo, M.C. (1998) Cannibalistic interactions resulting from indiscriminate predatory behavior in tadpoles of poison frogs (Anura: Dendrobatidae). *Biotropica*, 30, 92–103.

Caldwell, J., Lima, A.P. & Biavati, G.M. (2002) Descriptions of Tadpoles of *Colostethus marchesianus* and *Colostethus caeruleodactylus* (Anura: Dendrobatidae) from their Type Localities. *Copeia*, 1, 166–172.

Grant., T., Frost, D.R., Caldwell, J.P., Gagliardo, R., Haddad, C.F.B., Kok, P.J.R., Means, D.B., Noonan, B.P., Schargel, W.E. & Wheeler, W.C. (2006) Phylogenetic systematics of dart–poison frogs and their relatives (Amphibia: Athesphatanura : Dendrobatidae). *Bulletin of the American Museum of Natural History*, 299: 1–262.

Medina–Müller, M. (2006) *Factores que Influyen en el Canibalismo entre Renacuajos de la Rana Venenosa* Dendrobates biolat *Morales 1998 (Anura: Dendrobatidae)*. Tesis, Licenciatura. Universidad Ricardo Palma, Lima, Perú, 56 pp.

Maldonado, M. & Reichle, S. (2007) Primer registro de *Ranitomeya biolat* (Morales, 1992) (Anura: Dendrobatidae) para Bolivia, con apuntes sobre la nueva nomenclatura de Dendrobatidae. *Kempffiana*, 3, 14–17.

Morales, V.R. (1992) Dos especies nuevas de *Dendrobates* (Anura: Dendrobatidae) para Perú. *Caribbean Journal of Science*, 28, 191–199.

Schulte, R. (1986) Eine neue *Dendrobates–* Art aus Ostperu (Amphibia: Salientia: Dendrobatidae). *Sauria*, 8, 11–20.

Summers, K. & McKeon, C.S. (2004) The evolutionary ecology of phytotelmata use in Neotropical poison frogs. *In*: R.M. Lehtinen (Ed.) *Ecology and Evolution of Phytotelm–breeding Anurans*. *Miscellaneous Publications Museum of Zoology*, *University of Michigan* 193, pp. 55–73.

Waldram, M. (2008) Breeding biology of *Ranitomeya biolat* in the Tambopata region of Amazonian Peru. *Journal of Herpetology*, 42, 232–237.